

AUTUMN MIGRATION OF BROAD-BILLED SANDPIPER (*LIMICOLA FALCINELLUS* PONTOPP.) IN KAZAKHSTAN¹

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Observations in 1975-1985 in Kazakhstan showed that autumn migration of Broad-billed Sandpiper begins in July (mean date is July 18) and lasts up to end of August or middle of September (mean date is September 7). First of all adult birds migrate and juveniles follow them some time later. Differences in migration dates, wing-length and weight of adults and juveniles, males and females are discussed also.

The Broad-billed Sandpiper (*Limicola falcinellus* Pontopp.) is a rare wader species in our fauna. The biology, including breeding and migratory activities is still insufficiently known (Gladkov 1951, Kozlova 1962). As to its autumn migration the Broad-billed Sandpiper was recorded in different regions of Kazakhstan only about 10 times (Dolgushin 1962). Thus data on Broad-billed Sandpiper collected over the last several years are an essential supplement to the available literature.

Investigations on the Broad-billed Sandpiper's autumn migration were conducted in Central Kazakhstan in 1975-1977, namely in reservoirs of the lower reaches of Turgai river (48°28'N, 62°09'E); in Tengiz-Kurgaldjinskaya cavity [Kipshak lake (50°12' N, 68° 24' E) and Tengiz lake (50°32' N, 69°20' E); 1983]; in the overflow of artesian chink near Telikul lake system in the lower reaches of Sarysu river (42° 30' N, 67° 10' E; 1986); in south-eastern part of the republic in 1977-1985, namely in Sorbulak that is a reservoir accumulating sewage in the environs of Alma-Ata (43° 46' N, 76° 05' E); in Sasykkol lake (Balkhash-Alakkol hollow, 46° 41' N, 80° 36' E; 1981).

In July-September birds were trapped with mist nets and "daradanes" of 10-75 m length. Traps were used to determine the number of small waders (Gavrilov 1980). The standard length of a net was 10 m and net used per twenty-four hours was 100.

The age of the captured Broad-billed Sandpipers (total number 376) was determined from the form of tertials feathers apex, its shabby appearance, colour of throat and crop. The maximum wing length was calculated with the help of a stop-ruler. Balance VLTK-500 (accurate to 0.1 g) was used to obtain weight.

Statistical treatment was done on microcalculator Casio fx-39. A number of figures of less than 50 were considered as small selection. Median date of Broad-billed Sandpiper passage was determined when 50% of the birds were captured (Preston 1966).

The arrival of the first Broad-billed Sandpiper in Central and South-Eastern part of Kazakhstan did not differ: in July it was 9-23, mean data of 5 years-July 18 ($\sigma = 6.93$), in July 10-25, mean data of 9 years was July 18 ($\sigma = 5.36$) respectively. On Sorbulak lake over a period of 8 years early migratory activities were observed in 1977, 1979-1981, 1983 (mid July), and late ones — in 1978, 1982 and 1985 (late July), with the variation of their first arrival being 14 days.

The total dynamics of migration is characterized by two passage waves — from mid July till early August, and from mid August till early September (Table 1). This is a result of a considerable difference in the periods of juvenile and adult migratory activities. Adults are initiators of the passage. In Central Kazakhstan median date of their migration - July 22, in south-eastern part-July 27, as a whole for the Republic-July 26. In Central Kazakhstan the last few adults were recorded during July 23-August 15, mean data of 4 years was August 4 ($\sigma = 9.43$), in south-eastern part

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during July 29-August 26, mean data of 9 years was August 11 ($\sigma= 8.04$). In the south-eastern part of the Republic migratory activities of adult Broad-billed Sandpipers usually come to the end in early August, but in 1982, when passage began only in July 23, birds were recorded till August 26, so that in the second half of the month, 8 of them were captured, which represented 72.7% of the total number for the whole year.

Juveniles began their autumn passage a month later than adults. In Central Kazakhstan the first juveniles were captured in August 13-16, mean data of 4 years was August 15 ($\sigma= 2.06$), in south-eastern part of the Republic in August 3-22, mean data of 7 years was August 14 ($\sigma= 6.80$). Median dates of their passage are August 25 and 26 respectively, as a whole for the Republic-August 25. In Central Kazakhstan the last few Broad-billed Sandpipers were recorded in August 18-September 17, mean data of 4 years was August 29 ($\sigma= 13.25$). The data did not correspond to the actual situation, as in 1975, 1976 and 1983 there was no trapping work in September at all. In the Tengiz-Kurgaldjiin a juvenile female was trapped in September 10, 1969. Taking this date into account August 31 is an average date for the end of the passage according to

5 years of investigation ($\sigma= 12.72$). In the south-eastern part of the Republic the last few juveniles were recorded in August 22-September 16, mean data of 7 years was September 3 ($\sigma= 9.44$). Excluding 1977, 1980 (no trapping work in September), last juveniles were captured in August 29-September 16, average data of 5 years was September 7 ($\sigma= 8.41$).

The analysis of the above material showed simultaneous passage movement of Broad-billed Sandpipers across the whole territory of Kazakhstan. As to median dates of juvenile and adult migration, in south-eastern parts they are 5 or 1 day later. Completion of passage in this territory was somewhat later also.

The Broad-billed Sandpiper chicks are cared for by both parents at the beginning, but later on female leaves the brood and only the adult male takes care of the chicks (Cramp and Simmons 1983). There is an assumption that in eastern subspecies of the Broad-billed Sandpiper the female does not take any part either in incubating or in caring for the young (Flint 1973). According to this biological specificity adult females have to acquire their Autumn migratory disposition earlier than the males. In different years adult females were recorded

TABLE I
AUTUMN MIGRATION DYNAMICS OF BROAD-BILLED SANDPIPER IN KAZAKHSTAN
(BASED ON CAPTURE DATA)

Region	Months																Total
	July						August						September				
	2	3	4	5	6	1	2	3	4	5	6	1	2	3	4		
Central																	
Ad.	—	10	4	6	6	3	—	1	—	—	—	—	—	—	—	30	
Juv.	—	—	—	—	—	—	—	5	15	13	20	3	4	1	1	62	
Total	—	10	4	6	6	3	—	6	15	13	20	3	4	1	1	92	
South Eastern																	
Ad.	1	4	38	35	62	20	17	2	6	2	1	—	—	—	—	188	
Juv.	—	—	—	—	—	1	1	5	18	22	33	11	3	1	1	96	
Total	1	4	38	35	62	21	18	7	24	24	34	11	3	1	1	284	

in July 16-August 6, average date was July 23 ($n = 3$; $\sigma = 12.12$), adult males in July 20-August 16, average date was July 30 ($n = 5$; $\sigma = 10.48$). Sexual dimorphism is clearly expressed in Broad-billed Sandpiper's size and females have a longer wing span than males (Cramp and Simmons 1983). We have analysed changes in wing length throughout the season. Mean maxima of wing length for adults in Sorbulak lake (1980-1985) in July was 107.4 mm ($n=40$; $\sigma = 2.24$) in August 106.2 mm ($n=22$; $\sigma = 2.05$). Average weight for adult males was 32.6 g ($n = 4$; $\sigma = 6.04$), for adult females 37.5 g ($n=2$; $\sigma = 6.93$). In the first half period of migration (till July 26) average weight figures of adults in Sorbulak lake was 38.3 g ($n=90$; $\sigma = 5.61$), later on 37.9 g ($n=81$; $\sigma = 5.72$). Though differences in wing length and weight in different periods of migration are statistically doubtful, reduction of these parameters show a slight prevalence of males over females in the second half of their passage.

Among juveniles males were recorded during August 3-September 10, average date was August 26 ($n=7$; $\sigma = 13.37$), females during August 13 - September 13, average date was September 1 ($n=12$; $\sigma = 9.65$). As juvenile females are larger than males (Cramp and Simmons 1983), we have analysed seasonal changes of average wing length in birds captured on Sorbulak lake (1980-1985). In the 2nd and 3rd weeks of August it was 106.7 and 106.6, in September — 106.6 mm ($n=14, 14$ and 5 ; $\sigma = 3.07, 2.65$ and 1.82 respectively), i.e. were identical. In the lower reaches of Sarysu river (1986) juveniles were seen in August 13 — September 17; in August 19-23 there was no birds at all. The average maximum wing length recorded till August 18 was 108.4 mm ($n=7$; $\sigma = 2.94$), later on 106.5 mm ($n=35$; $\sigma = 3.17$); birds captured in September it was 106.5 mm ($n=9$; $\sigma = 3.24$). Due to this data juveniles (as also adults) with short wing length (presumably male) were more frequent at the end

TABLE 2

GEOGRAPHICAL VARIATIONS OF WING LENGTH AND MASS FIGURES IN BROAD-BILLED SANDPIPERS IN KAZAKHSTAN

Region in Kazakhstan 1	Age 2	limits 3	$M \pm m$ 4	σ 5	n 6
wing length, mm					
Central	Adults	100-112	106.1±0.7116	3.0190	18
South-eastern	Adults	102-113	106.95±0.2798	2.2028	62
Total	Adults	100-113	106.8±0.2701	2.4161	80
Central	Juveniles	98-113	106.9±0.4236	2.9950	50
South-eastern	Juveniles	102-113	106.6±0.4643	2.6671	33
Total	Juveniles	98-113	106.8±0.3136	2.8571	83
weight, g					
Central	Adults	26.0-46.3	34.4±1.0420	5.7075	30
South-eastern	Adults	23.6-52.1	38.2±0.4333	5.6656	171
Total	Adults	23.6-52.1	37.6±0.4100	5.8132	201
Central	Juveniles	22.0-54.4	35.7±0.9181	6.9308	57
South-eastern	Juveniles	22.5-45.4	33.1±0.4817	4.7198	96
Total	Juveniles	22.0-54.4	34.1±0.4676	5.7842	153

of their migratory activity, though average dates of male and female records did not coincide with these data.

Our investigations showed that in the juvenile female weight figures were larger than in males. For females 24.4-38.7 in average 35.4 g ($n=12$; $\sigma = 4.53$); for males 22.0-37.2, average 30.1 g, ($n=7$; $\sigma = 5.20$). On Sorbulak lake through the first half of the migratory period (till August 26) average weight of juveniles was 32.8 g ($n=57$; $\sigma = 4.76$) and later on — 33.6 g ($n=39$; $\sigma = 4.68$); in the low reaches of Sarysu river it was 33.9 g ($n=15$; $\sigma = 6.00$) and 38.7 g ($n=27$; $\sigma = 7.15$) respectively.

Thus adult males start migrating somewhat later than the females as is clear from average dates of migration and decreasing of average wing length and weight of birds to the end of their migration. Differences in migratory dates are not large, to ensure that females take part in caring for chicks. For juveniles, there is no clear picture. On certain dates females make their passage later than the males, increase of average migratory mass in the second half of migration is a confirmation of it; wing length figures do not change or decrease. For the last case it means prevalence of males over females. It is necessary to stress that weight figures are not a reliable index of male or female prevalence, as is defined by the physiological state of a bird (by

amount of fat storage).

Population differences are not clearly expressed in Broad-billed Sandpipers passing across Central and South-Eastern Kazakhstan (Table 2). In both age groups differences in average wing length in these regions was less than 1 mm. Differences in weight were not equal, in the south-eastern part of the Republic they were larger for adults by 3.8 g; in Central Kazakhstan for juveniles by 2.6 g. Perhaps, it is connected with variations of food storage in these regions, and also with differences in migratory strategy.

Average weight figures of adults compared to juveniles in different years showed that juveniles had annual weight 1.2-8.7 g less than adults (Sorbulak lake); in the low reaches of Sarysu river such figures comprised 0.5 g, in Kurgaldjiin lakes juvenile's weight exceeded adult's by 1.4 g (Table 3).

On Sorbulak lake during the period of 1977-1985 out of 264 Broad-billed Sandpipers 39 (14.8%) were recaptured. From 164 adults, 17 (10.4%) had breaks in their passage, from 100 juveniles, 22 (22.0%) had done so, an average duration of such breaks form 10.1 and 6.5 days respectively. In Central Kazakhstan (1975-1986) out of 87 Broad-billed Sandpipers 14 (16.1%) were recaptured. From 30 adults, 6 (20.0%) had breaks in their

TABLE 3

CHANGES IN AVERAGE WEIGHT FIGURES OF ADULT AND JUVENILE BROAD-BILLED SANDPIPER FOR SEVERAL YEARS DURING THEIR AUTUMN MIGRATION IN KAZAKHSTAN

Locality	Year	Adults			Juveniles		
		M	σ	n	M	σ	n
Sorbulak lake	1977	38.6	6.0021	36	31.3	4.5596	4
	1978	38.0	5.4360	27	32.7	3.0807	26
	1979	40.5	5.2569	43	34.7	4.6217	33
	1980	36.9	4.9852	17	30.4	4.5608	10
	1981	34.9	5.1753	25	26.2	3.0501	3
	1982	36.1	6.3977	11	34.9	6.1043	9
	1983	38.5	5.2123	7	—	—	—
	1985	41.7	5.3740	2	32.3	5.6388	11
Lower reaches of							
Sarysu river	1986	37.5	8.1540	5	37.0	7.0719	42
Kurgaldjino	1983	32.9	4.3771	13	34.3	3.9206	8

TABLE 4

CHANGES IN WEIGHT FIGURES IN RECAPTURED BROAD-BILLED SANDPIPER IN KAZAKHSTAN
DUE TO BREAK IN PASS AGE

	Breaks (days)				
	1-3	4-6	7-10	11-15	16-31
Weight increases	5	9	5	6	6
Weight decreases	13	6	3	5	5
Average weight change, g	-1.3	+1.8	+3.3	+2.3	+3.1
Number of data	18	15	8	11	11

passage, and from 57 juveniles, 8 (14.0%) had stayed an average duration of 2.5 and 12.4 days respectively.

The change in weight in resting Broad-billed Sandpipers varied according to the duration of their resting time (Table 4). During the short period of time after trapping (up to 3 days) the birds (72.2%) showed decrease in their weight, being in mean 1.3 g for every bird. Such a phenomenon is a characteristic for many species being a result of stresses the birds are exposed to in captivity. Prolonged resting time led to a total increase of weight, and some individuals showed excellent ability to fat accumulation. In a 4 day period their weight increased by 6.7 g, in 5 days- 9.4 g, in 6-10.4, in 9-15.9, in 15-15.4, in 19-17.2 g.

Accumulation of stored fat during the resting period up to 10 days averaged 0.3-1.8 g/twentyfour hours, and for more than 10 days 0.4-0.9 g/twenty-four hours. The decrease of weight was sometimes recorded during a period of long rest, and could be explained by physical traumas of birds in mist-nets (injury of wing, foot) that disturb their vital activity. On Sorbulak lake under conditions of positive weight balance, mean weight of 7 adults during their resting time increased from 35.8 to 41.3 g (15.4%) in 11 juveniles from 33.5 to 40.7 g (21.5%), in the lower reaches of Sarysu river for 6 juveniles from 30.2 to 38.8 (28.5%). In the last case mean weight of juveniles, captured during the same period of time, but without recaptures, was 38.0 g (n=22; $\sigma = 6.28$), i.e. practically similar to birds which had accumulated stored fat during their resting time. As a rule birds with less weight stopped their passage for a resting period, though there were exceptions.

Thus in August a captured juvenile weighed 37.2 g and after 9 days 53.1 g; a juvenile caught in August 21 weighed 43.1 g, and after 5 days 52.5 g.

The Broad-billed Sandpiper is low in numbers everywhere in Kazakhstan. In reservoirs of Central Kazakhstan they comprised in different years 0.27-2.26, on an average 1.39 birds for 100 nets/twenty four hours; in the south-eastern part up to 6.28, and an average 2.43 birds for 100 nets/twentyfour hours. The largest change in number was noted in Sorbulak lakes. In the first years of the lake's formation there was a considerable number of Broad-billed Sandpipers. Beginning from 1980 a progressive decrease in the number of resting birds was noted (coinciding with decrease of average weight in adults and juveniles). In 1984 none of the Broad-billed Sandpiper were met, though from 1985 they began to stop there again. Marked variations in number were connected with changes of ecological situation, and as a result changes in food storage. In the whole of the south-eastern part of the Republic Broad-billed Sandpiper's number was 1.75 more than in the central part.

Usually Broad-billed Sandpiper had 4, rarely 3 eggs in its clutch in a year. The number of lost nests and fledged chicks are not known (Cramp and Simmons 1983). In our material (Table 5) age ratio (adults and juveniles) during the period of their passage along the lower reaches of Turgai river and Kurgaldjino, was 1:0.76 (capture was done only in July and August). In the lower reaches of Sarysu river it was 1:8.6. In total in reservoirs of Central Kazakhstan for one adult 2.07 juveniles were captured, which exceeds the natural fecundity of the Broad-billed Sandpiper. During many years

adults were seen on Sorbulak lake though capture activity continued till October. In 1978-1979 adults and juveniles migrated in good numbers and age-ratio was 1:0.84. On the whole the age-ratio was 1:0.51 in the south-eastern part of the Republic.

The Broad-billed Sandpipers migrate in a wide front in Autumn across the land and concentrated flyways are lacking (Cramp and Simmons 1983). Only in Crimea flocks of up to some hundreds of birds were recorded (Kostin 1983). Usually solitary birds, small groups of flocks comprising 20-30 birds were observed. That is why

the assumption that age ratio in Autumn migration reflects their fecundity, is correct. In this case low breeding level was observed in 1977, 1981, 1983, and high one in 1978, 1989, 1985. Perhaps it is breeding success that resulted in number variations of Broad-billed Sandpiper during their Autumn passage as recorded by several authors (Nankinov 1985). At the same time a great number of juveniles, caught in 1986 in the lower reaches of Sarysu river in Telikyl lakes when the median date of their migration was August 26, leads to the supposition that a concentrated stream of juveniles pass in some years through this region.

TABLE 5

NUMBER AND CORRELATION OF AGE GROUPS OF BROAD-BILLED SANDPIPER DURING THE AUTUMN MIGRATION IN DIFFERENT REGIONS OF KAZAKHSTAN

Locality	Year	Number of nets/ 24 hours	Birds caught	Number on 100 net/24 hours	Captured	
					Ad.	Juv.
Lower reaches of Turgai river	1975	480	8	1.67	4	4
	1976	618	14	2.26	7	7
	1977	374	1	0.27	1	0
Kurgaldjino, Kipshak lake	1983	1153	21	1.82	13	8
Lower reaches of Sarysu river	1986	3983	48	1.21	5	43
Central Kazakhstan		6608	82	1.39	30	62
Sorbulak Lake (Alma-Ata region)	1977	759	40	5.27	36	4
	1978	1089	53	4.87	27	26
	1979	1209	76	6.29	43	33
	1980	788	28	3.55	18	10
	1981	1251	28	2.24	25	2
	1982	1828	20	1.09	11	9
	1983	1055	7	0.66	7	0
	1984	1598	0	0	0	0
	1985	1392	14	1.01	3	11
Sassykkol lake	1981	?	18	?	18	0
South-eastern Kazakhstan		10969	266	2.43	188	96

The prevalence of adults in their Autumn passage in south-eastern Kazakhstan and juveniles in Central part, taking into account a month difference in the period of their migration may be explained as under. In July, when adults migrate, feeding conditions are more favourable in South-eastern Kazakhstan and Broad-billed Sandpipers increase their resting time, increase in weight and the probability of catching them in mist-nets increased. Analogical situation can be observed in Central Kazakhstan (August), when juveniles pass, resulting in high capture figures. As differences in resting time of adults and juveniles can be compared, we can suppose that they average a total number of different age groups captured in Kazakhstan. The total age-ratio being 1:0.72 in Kazakhstan (218 adults and 158 juveniles) correlates average fecundity of species, i.e. one pair of adults to 1.5 juveniles surviving in Autumn.

The migratory route of the Broad-billed

Sandpipers passing through Kazakhstan is not known. Of the 366 ringed birds there were 3 return. From adults ringed on Sorbulak lake in July 30, 1979, one was recovered here in July 10, 1980, another in Sassykkol lake (Balkhash-Alakkoul Hollow) in July 29, 1981, 505 kilometres from the ringing site. One more adult Broad-billed Sandpiper ringed on Sorbulak lake in July 18, 1983 was captured here on August 18, 1985. These indicate constant route of migration of some birds and confirm their passage to their winter breeding places round Tian-Shan range system, that is a characteristic for many species of birds in this region of Kazakhstan.

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